Pointing and Spatial Acquisition in the Presence of Satellite Vibrations for a Free Spare optical Communicant ion 1 ink

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ABSTRACT

1 aser communication systems offer distinct advantages over radio frequency systems for near earth anti deep space communication links. Some of the advantages are smaller size, lower power requirements and higher data rat es. I lowever, last'r beamwidths are extremely narrow and so pointing, acquisition and tracking (PA']') are much more difficult than those' for radio frequency based communication systems. in addition to imprecise knowledge of relative position of and complex relative' motion between the' spacecrafts, the problem of poin t i ng and acqui sit ion is complicated by vibrations or jit ters present in the spacecraft. Optical systems can p r o d u c e beams of one microradian divergence. This leads to submicroradian ji t t er stabili ty req uirements for closed loop tracking and pointing, together with the requirement for rapid initial acquisition. This paper analyzes the' impact of spacecraft vibrations on the acquisition time and probability of acquisition between a geostationary satellite' (GEO) and a low earth orbiting satellite (1 .EO). The relationship between the probability of acquisition and pointing errors due to satellite vibration are obtained through computer simulation. Also, a spectral analysis of the jitter is performed to reveal requirements for the' jitter rejection in the closed loop tracking system.

Author Biography

Prakash R. Chakravarthi is a Resident Research Associate at the Jet Propul sion Laborat ory u nder the sponsorship of the National Research Council. He obtained his Ph.D. in Electrical Engineering from Syracuse Universit y, Syracuse, New York where he focu sed on radar weak signal detection for h i s dissertation. His research interests include communication theory, optics and digital signal processing.